

# Hydroacoustic Project Development

## *A Case Study*

### **I-5: Willamette River Bridge (WRB) Replacement**



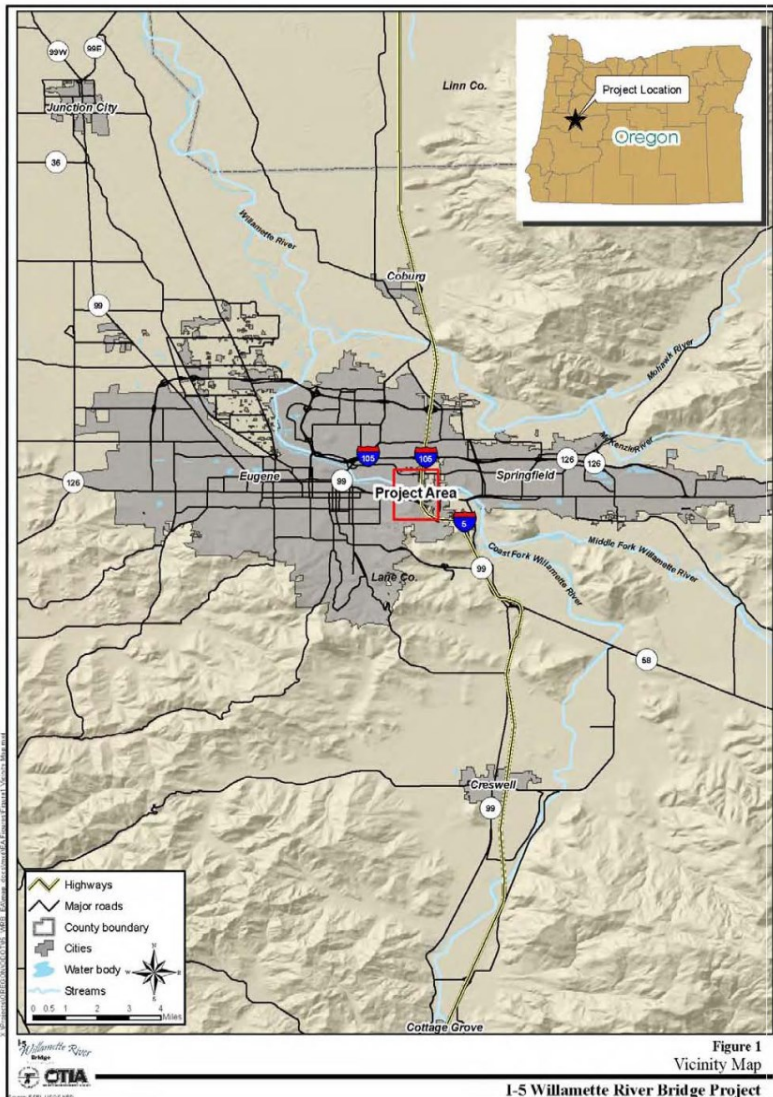
***ODOT Hydroacoustic Training***  
***May 14, 2009***

# Discussion Topics

- WRB project overview
- Work/containment structure
- In-water work window
- Hydroacoustic monitoring
- Hydroacoustic attenuation



# Project Overview



- Replace decommissioned WRB and WRB detour bridge with twin deck arch structures
- Largest OTIA III Project
- First ODOT CM/GC project
- One year design/permitting schedule



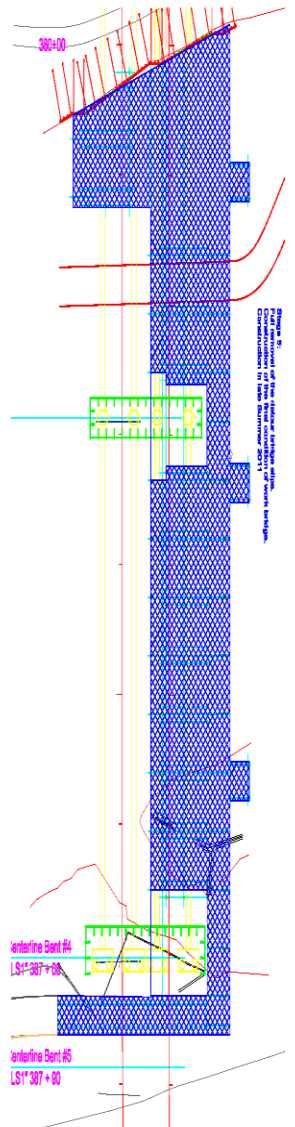
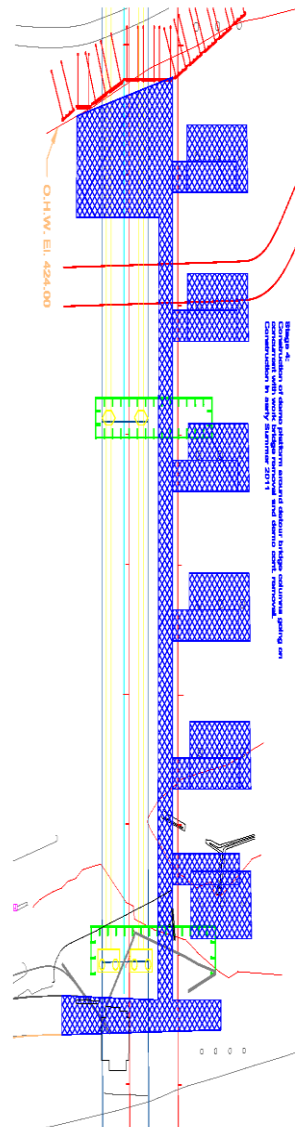
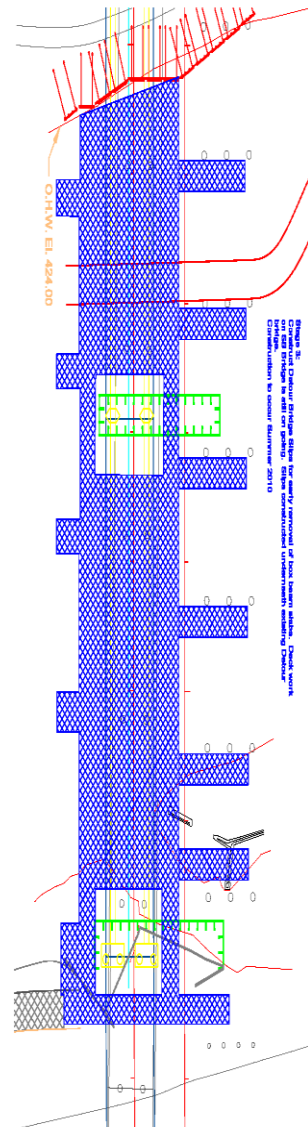
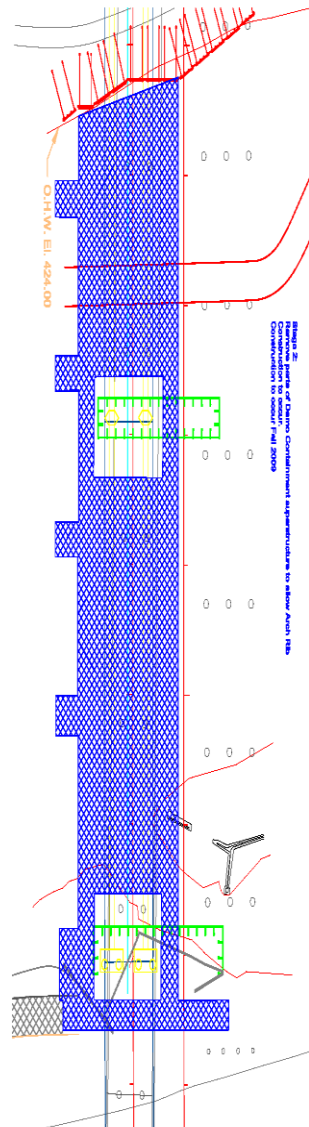
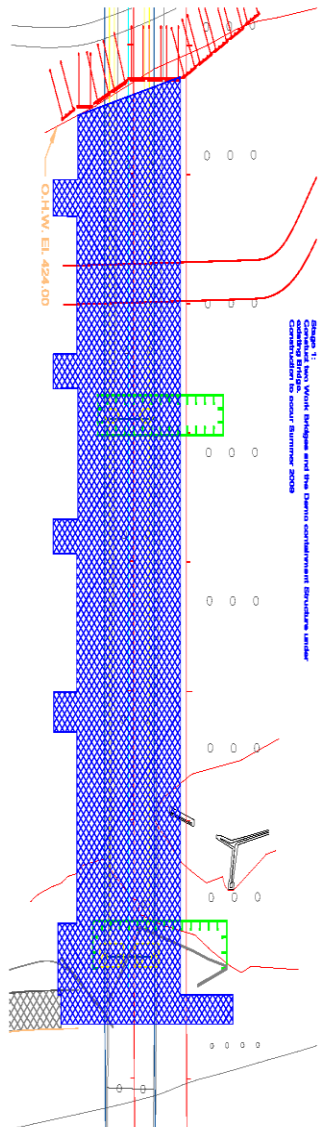
# Work/Containment Structure Development

- Large river crossing
- Four-year project
- Cofferdam?
- Bedrock substrate
  - Non-intrusive supports?
  - Vibratory hammer?

*Impact-driven pile-supported structure chosen*



# WRB Work/Containment Structure



# Willamette River In-Water Work Window

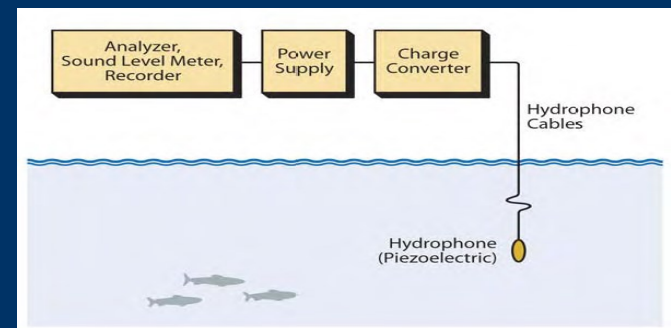
- Published IWWW June 1 – October 31
- Listed spring Chinook salmon migration (May-August)
- Agency concerns re: pile driving during migration and effects
- Project-specific pile driving IWWW April 1-30 and July 1-Oct 31
- Hydroacoustic monitoring required



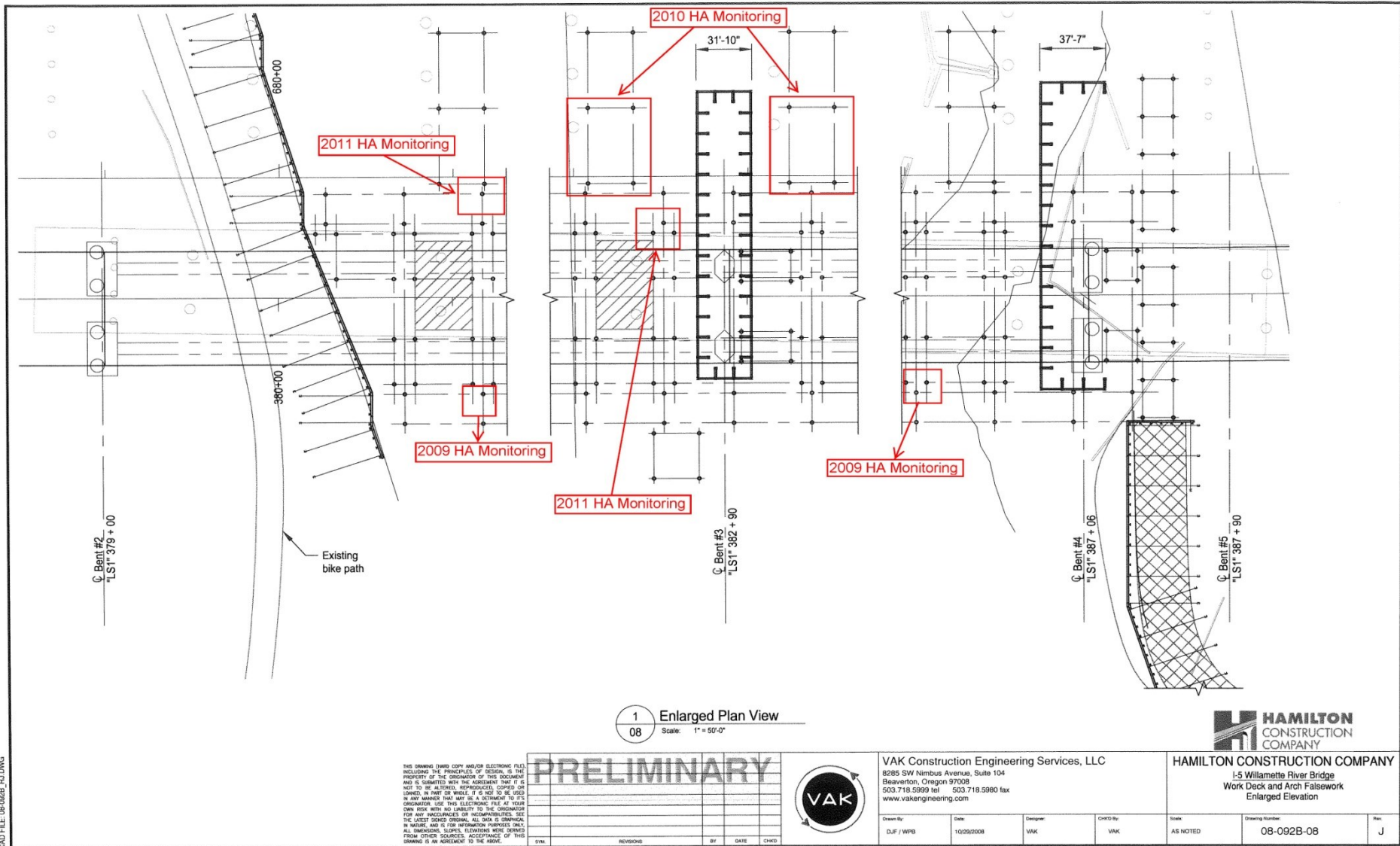


# Hydroacoustic Monitoring Plan

- Hydroacoustic monitoring per WSDOT template
- Monitoring of 35 piles over three years
- Two hydrophones instead of one
- Monitoring with/without attenuation device on
- Locations representative of varying channel conditions



# Hydroacoustic Monitoring Locations



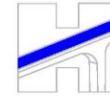
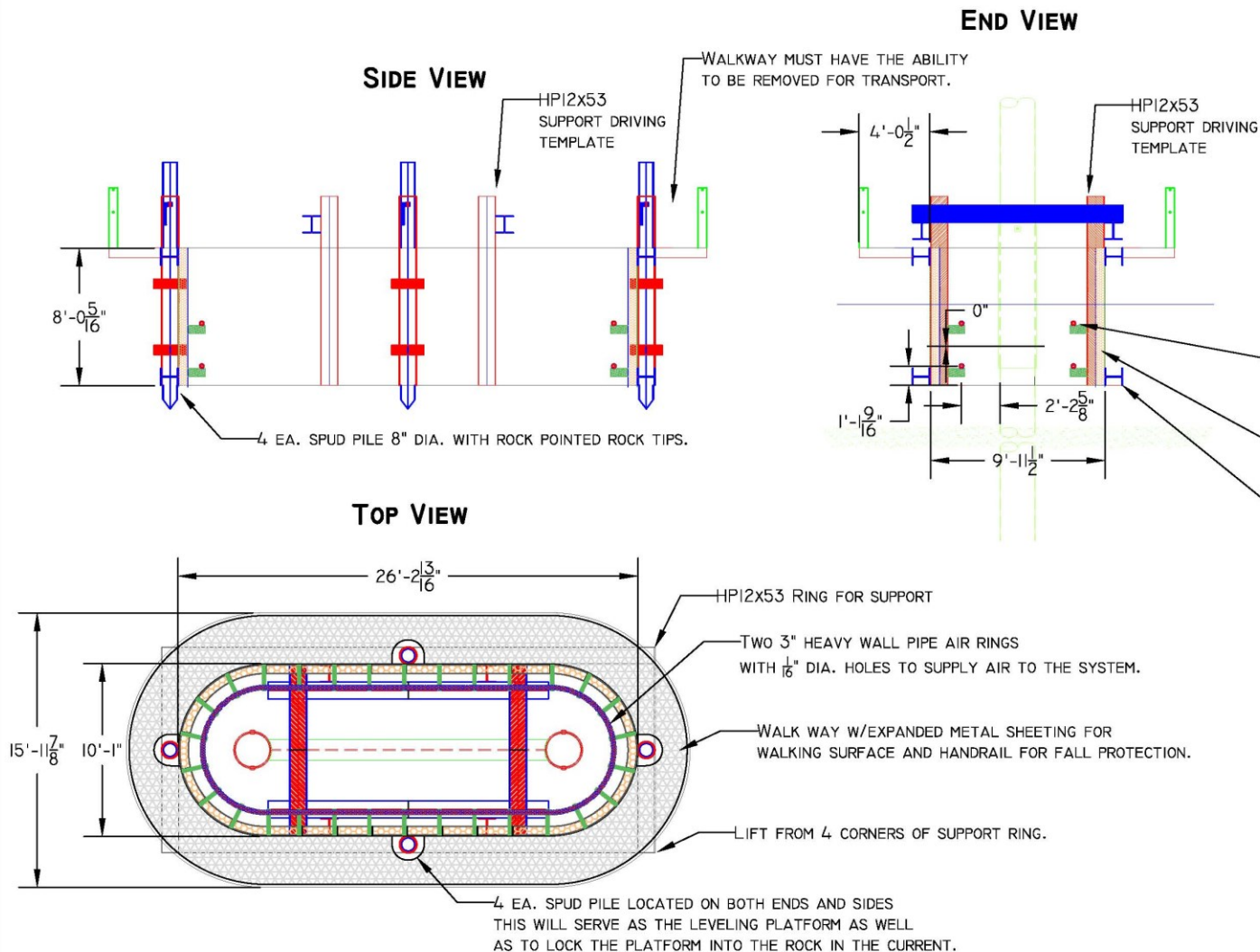


# Hydroacoustic Attenuation



- Confined bubble curtain
- Constraints
  - Bedrock substrate
  - Work platform conflicts
- Solution - pile template & “K” frame
- Clam shell design
- Speeds up construction & ensures proper pile placement

# Confined Bubble Curtain



HAMILTON  
CONSTRUCTION

DATE: 3-12-2009

DRAWN BY:  
B. Young

SHEET  
1 OF 6

## Willamette River Bubble Curtain

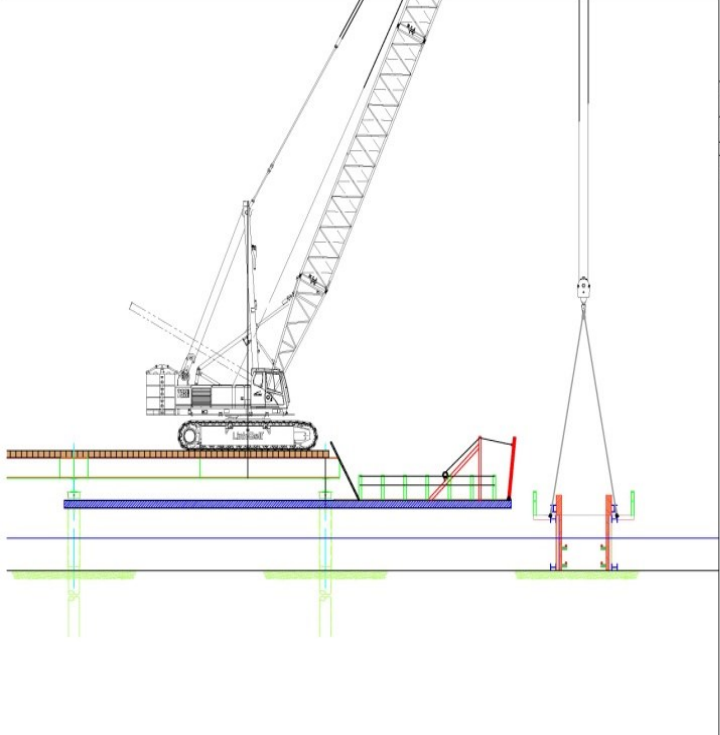
SCALE NONE View

Bubble curtain to weigh less than 25 kips, idea is that it would have enough weight that you could hoist with single line pull of crane and set in river around area to be driving pile. Needs to be heavy to be able to withstand the current in river. The idea of this style system is that it serves as our template for driving pile as well as sound isolation.

TWO 3" HEAVY WALL PIPE AIR RINGS WITH  $\frac{1}{16}$ " DIA. HOLES TO SUPPLY AIR TO THE SYSTEM.

6" MARINE ACOUSTIC INSULATION TO DAMPEN NOISE TRANSFER OUT OF BUBBLE CURTAIN.

HP12x53 RING FOR SUPPORT





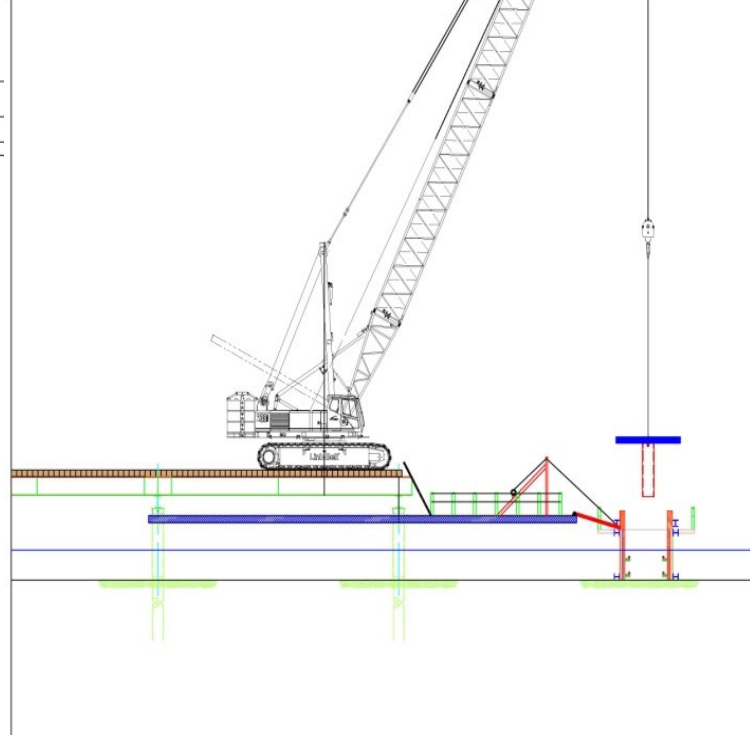
**HAMILTON  
CONSTRUCTION**


DATE: 3-12-2009	DRAWN BY: B. Young	SHEET: 2 OF 6
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**Willamette River Bubble Curtain**

NAME: NONE	TYPE: SB WB/ROCK QUANTITY
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#1. Load access platform  
#2. Set Bubble Curtain into place.





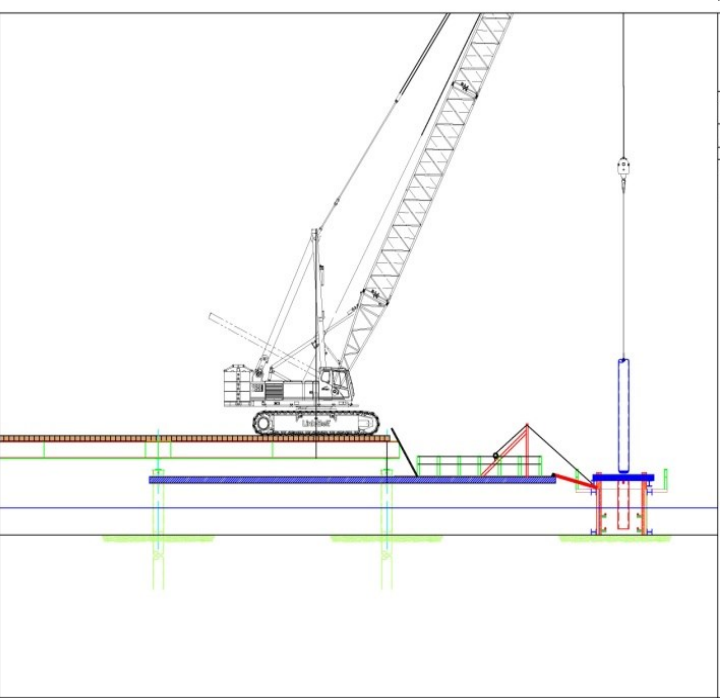
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CONSTRUCTION**


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**Willamette River Bubble Curtain**

NAME: NONE	TYPE: SB WB/ROCK QUANTITY
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#3. Load K-Frame into Bubble Curtain template.





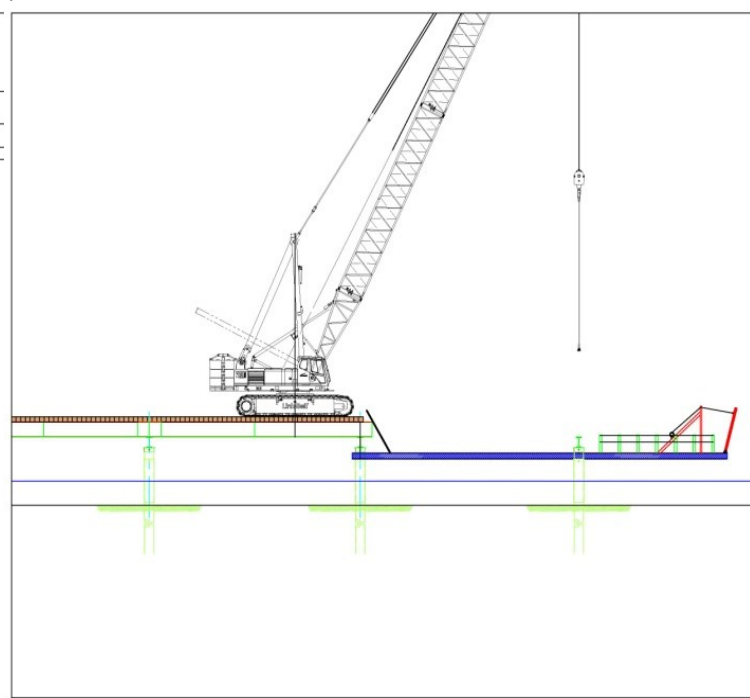
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**Willamette River Bubble Curtain**

NAME: NONE	TYPE: SB WB/ROCK QUANTITY
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#4 Load Pile into K-Frame.  
#5 Drive Pile.





**HAMILTON  
CONSTRUCTION**

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**Willamette River Bubble Curtain**

NAME: NONE	TYPE: SB WB/ROCK QUANTITY
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#6 Remove bubble curtain.  
#7 Advance access platform.  
#8 Cut cap and brace bent.



# Conclusion

- Large project with compressed design and permitting schedule
- Hydroacoustic concerns given work bridge type and Chinook salmon run timing
- Hydroacoustic monitoring to determine sound levels in a unique environment and attenuation
- Will help guide future decisions and work addressing transportation project hydroacoustic issues

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